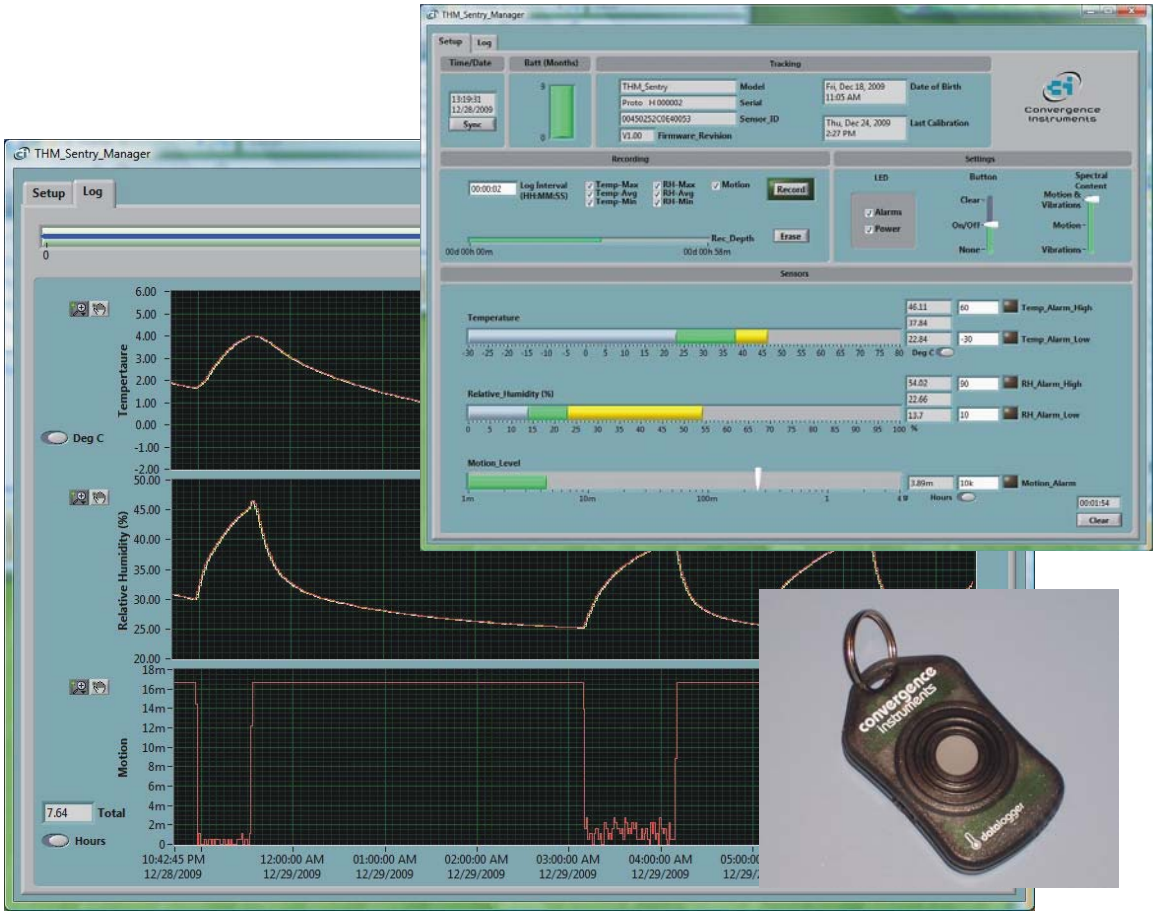
Convergence Instruments

THM Sentry

User's Manual



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1 Product Description

The *THM Sentry* series of instruments are high-performance temperature, humidity and motion data loggers. They include a high-resolution temperature sensor, a high-resolution relative humidity sensor, a motion and vibration sensor, an accurate date/time clock and a non-volatile 12000-point recording memory. The motion sensor measures the number of motion events where the acceleration is above an adjustable threshold, or the number of hours of operation. The very small size of these instruments allows them to be attached to or embedded within the monitored equipment.

There are presently two models in the series:

- ***THM12N*:** Includes Temperature, Humidity and Motion sensors
- ***TM12:*** Includes Temperature and Motion sensors

2 Features

The *THM_Sentry* series include the following features:

Feature	TM12	THM12N
Sensors	Temperature, Motion	Temperature, Humidity, Motion
All-digital design	✔	✔
NIST traceable		✔
Very high temperature resolution and precision	✔	✔
Very high relative humidity resolution and precision		✔
Adjustable motion type (Motion/Vibrations/Both) and threshold	✔	✔
Counts motion events or hours of operation	✔	✔
Extremely long battery life	✔	✔
Alarms on all measurements	✔	✔
Non-volatile memory, preserves recorded data in case of battery failure	✔	✔
***THM_Sentry_Manager* application to setup operating and recording parameters, download, visualize and export data**	✔	✔
Displays data while recording	✔	✔
LabVIEW driver	✔	✔

3 Applications

- Logging hours of operation and duty rate of motors machinery and equipment.
- Monitoring of storage, transport conditions and movements of perishable items (fresh produce… etc.)
- Tamper-proof Monitoring of Environmental Conditions
- Monitoring of Storage Conditions for Musical Instruments and Other Delicate Items.
- Detection and logging of the handling of pieces of equipments (Asset Management).
- Monitoring of indoors and outdoors temperature and humidity conditions
- Monitoring of temperature and humidity for:
    - Museums
    - Freezers
    - Incubators
    - Exotic Animal Habitat
    - Electronic Equipment (Servers…)

4 Special Handling Instructions

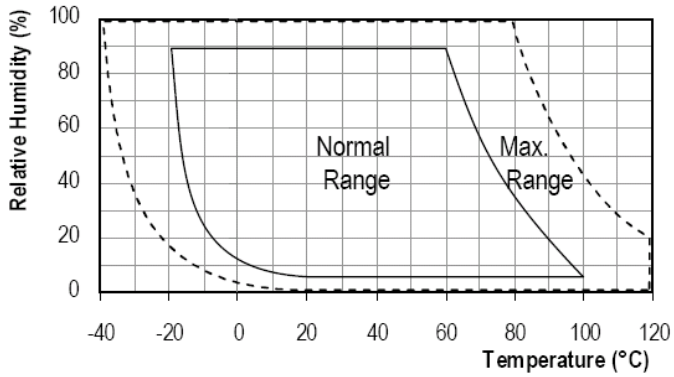
Chemical vapors at high concentrations, such as chemical solvents, out-gassing of glues, adhesive tapes etc. in combination with long exposure times may offset the relative humidity sensor reading (*THM12N* model only).

Operation and storage of the relative humidity sensor should be restricted to well ventilated areas.

Cleaning of the *THM Sentry* should only be done with a damp cloth. Avoid all chemical solvents as the vapors may damage the humidity sensor.

Do not submerge the *THM Sentry* in liquids.

THM12N: Long term exposure to conditions outside Normal Range, especially at humidity > 80 % RH, may temporarily offset the RH reading (+3%RH after 60h). After return into the Normal Range it will slowly return toward its calibration state by itself. Prolonged exposure to extreme conditions may accelerate ageing.



TM12 and THM12N: Operation and storage beyond its specified temperature range (-30 $^{\circ}C$ to 80 $^{\circ}C$) may damage the instrument.

Operation and storage of the *THM_Sentry* in condensing atmospheres for long periods of time, such that corrosion may occur, risks damaging the instrument.

Only use the MLI cable provided with the *THM Sentry*.

When used outdoors make sure the instrument is not directly exposed to rain or sun light. As with any thermometer direct sun light will offset the temperature measurement. Water infiltration in the casing for long periods of time may damage the instrument.

5 Getting Started

5.1.1 Software Installation

1 Run *THM_Sentry_Installer.exe*. This installs the *THM_Sentry_Manager* application, as well as its *MLI* cable driver and documentation.

Note: Perform the software installation above BEFORE connecting the MLI cable into the PC.

5.1.2 Hardware Installation

1 Connect the *MLI* cable into an available USB port of the PC
2 Verify that the PC properly detects the cable and loads the driver. In case of doubt see the *Troubleshooting* section.

5.1.3 Initial Test and Configuration

1 If this is not already the case, insert a fresh CR2032 battery in the battery compartment. Be careful about battery polarity. See the *Battery Change* subsection in the *Maintenance* section for detailed instructions.
2 Upon battery insertion the LED starts blinking at a rate of once every two seconds. If the LED doesn't blink remove the battery, perform the reset procedure (see below) and insert the battery again. Make sure the battery is fresh.
3 Connect the *MLI* cable into an available USB port of the PC.
4 Connect the other end of the *MLI* cable into the side of the *THM Sentry.*
5 Go into *Start\All Programs\THM_Sentry*, and run *THM_Sentry_Manager.exe*. The front-panel described in figure 3 appears and the application tries to connect to the unit. If it fails to find the unit it indicates *No Device Found* and closes. If this is the case see the *Troubleshooting* section. Otherwise the application switches-on the *THM Sentry* and starts communicating with it.
6 If the Time and Date in the upper right corner of the application window are not properly adjusted the application asks if you want the time to be synchronized with the PC time.
7 Upon stopping the application the *THM Sentry* is switched off, except if it is recording.

5.1.4 Improving Communication Speed

When the *MLI* cable is initially connected to the PC, the PC detects it and provides an initial configuration. This configuration is functional, but does not provide the best communication speed.

To improve the communication speed, follow the steps below:

- Connect the *MLI* cable into the PC and wait for the PC to recognize it. The PC normally makes a sound to indicate that the cable is recognized and its driver is loaded.
- Windows Vista: Go into Control Panel>System and Maintenance>Device Manager.
  Windows XP: Go into Control Panel>Performance and Maintenance>System>Hardware>Device Manager.
- In the Device Manager open the *Ports (Com and LPT)* item. Double click on the item named *USB Serial Port*. Make sure that the manufacturer reads *FTDI*. Otherwise find another item named *USB Serial Port*.
- Select the *Port Settings* tab. In this page click the *Advanced* button.
- To the right of the *Latency Timer (ms)*, adjust the latency to 2 ms.
- Click OK to all the windows to close them.

6 Instrument Functions and Description

The instrument measures and optionally records:

- Current, average min and max temperature ($^{\circ}C$ or $^{\circ}F$)
- Current, average min and max relative humidity (%RH) (*THM12N* model only)
- Motion events or number of hours in motion
- Time

The unit connects to a PC via its *MLI* adapter cable. The *THM_Sentry_Manager* application is used to set its operating parameters and download recorded data.

Note: Only use the MLI cable provided with the THM Sentry.

Figure 1: *THM Sentry* front

1. *MLI* cable connector
2. LED indicator
3. *Multi-function button*
4. Temperature and/or humidity sensor

Figure 2: *MLI* adapter cable

7 Principles of Operation

The *THM Sentry* starts working as soon as the battery is installed. Upon battery insertion the LED starts blinking at a rate of once every two seconds. The *THM Sentry* starts measuring immediately. However it does not record at this point. Also its date and time are initially adjusted to December 1903.

The initial setup of the *THM Sentry* is as follows:

- LED displays power and alarms
- Button function set to On/Off
- Motion type selected is *Motion & Vibration*
- Motion threshold is set to 1/4g
- Recording max, average and min temperature, max, average and min humidity, and motion.
- 2s recording interval (0 h 58 m total recording depth)

The setup of the *THM Sentry* can be adjusted via the *THM_Sentry _Manager* application.

Pressing the button toggles between the switched-off state and the on-recording state.

The *THM Sentry* can operate and record data for up to 1 year on a small coin lithium battery.

7.1 Data Sampling

The instrument takes one measurement (temperature, humidity and motion) every 2 seconds. This pace is independent of the recording interval.

Minimum, maximum and averages values are calculated from these measurements at 2s intervals.

7.2 Motion Processing

Motion is measured by a high-resolution 3-axis accelerometer for a short 55ms interval in every 2s period. The amplitude of this acceleration is compared to the threshold adjusted by the user. If the amplitude is over the threshold a motion event is added to the motion totalizer for this 2s period.

The motion totalizer adds-up the total number of motion events detected, or the number of 2s intervals in motion, depending on the setting. This is actually the same information, displayed either in number of hours or number of events.

Filters can be added to the accelerometer signal:

- **Motion –Only** A low-pass filter filters-out high-frequency vibrations from the signal and only keeps motion. This is useful to make the sensor less sensitive to steady or transient vibrations. In this mode the instrument detects acceleration along any of the 3 axes, as well as any change in its inclination.
- **Vibration-Only** A high-pass filter filters-out low frequency motion from the signal and only keeps vibrations. This is useful to make the sensor less sensitive to slow motion and changes in its inclination.
- **Motion & Vibration** No filter is applied. The signal carries all of its components including slow-varying motion and inclination changes, as well as higher-frequency vibrations.

7.3 Power-On / Power-Off Behaviour

The unit is switched On in the following circumstances:

- When the battery is first inserted in the unit. In this case a recording is not automatically started.
- When the *THM_Sentry _Manager* application is started and takes control of the *THM Sentry*. In this case a recording is not automatically started.
- When the button has been enabled for On/Off function and is pressed. In this case a recording is automatically started.

The unit is switched Off in the following circumstances:

- When the button has been enabled for On/Off function and is pressed. In this case any ongoing recording is stopped.
- When the *THM_Sentry _Manager* application that was controlling the unit is exited. This can only occur if a recording is not in progress. If a recording is in progress the application exits but leaves the unit On and recording.

7.4 Recording

When the *THM Sentry* is recording it integrates measurements over the specified *Log Interval*. At the end of each log interval the selected statistics are written into solid-state memory. The statistics are then cleared to zero and the next measurement interval is started.

The data is collected every 2 seconds irrespective of the chosen log interval. The log interval should be chosen on the basis of the amount of unused memory and the expected duration of the recording. A shorter log interval will provide more data per unit of time, but will fill-up memory faster. A shorter log interval will not collect data at a faster rate.

The statistics that can be recorded are:

- Min, max and average temperature
- Min, max and average relative humidity level
- Motion totalizer (can be displayed as a number of motion events or number of hours of operation).

For instance if the *Log Interval* is set to 1 min, and the max and average humidity levels are selected, then each point in the log contains the max and average humidity levels measured over the preceding 1 min.

The *Log Interval* is adjustable in 2-second increments, from 2s to 12H.

The *THM Sentry* has a total combined recording depth of 12 000 points. For instance it can record 12 000 average humidity levels or 4 000 combined min, max and average humidity levels.

Each time the recording is started, using the *THM_Sentry _Manager* application or the multi-function button, a new log is created. Each log extends from the time the recording is started to the time it is stopped. Logs are stored sequentially in the recording memory. Creating a new log does not erase the data already stored in the unit. Each log can be set-up to record different statistics, and for a different interval. For instance a first log can be created, containing max humidity levels every two seconds for 10 minutes. Then a second log can be created, containing min, max and average temperatures every hour for 3 days. The *THM_Sentry _Manager* application is used to change the recording settings. It also provides access to all the logs in memory.

When the recording reaches the end of the memory, the recording is automatically stopped, but the unit stays On and keeps calculating the min and max temperature and humidity, as well as the motion. The alarm functions stay On also.

The recording memory can be cleared at any time to make room for new measurements by using the *THM_Sentry _Manager* application.

The memory is non-volatile. In case of battery failure, the data recorded up to the battery loss is preserved.

7.5 Ongoing vs. Recorded Statistics

The *THM Sentry* keeps two completely separate sets of statistics:

- **Ongoing:** The *ongoing* statistics (max, current and min temperature and humidity, as well as motion instantaneous level and totalizer) are displayed on the front-panel of the *THM_Sentry _Manager* application in real-time. These statistics are started any time the *Clear* button is pressed in the application front-panel and go on irrespective of any recording. The calculation of the *ongoing* statistics is reset when the unit is powered-on. Clearing the ongoing statistics does not affect a recording in progress. The alarms are based on the *ongoing* statistics.
- **Recorded:** The *recorded* statistics (max, min, average temperature and humidity levels and motion totalizer) are reset and restarted automatically at the end of each *Log-Interval* window. These statistics cannot be directly observed in real-time. To see the results the recorded logs must be downloaded from the unit and displayed or exported.

Of course these two sets of statistics are calculated from the same raw data taken at 2-second intervals.

7.6 LED Indicator and Alarms

The LED indicator can be used for two functions:

- **Power Indicator:** The LED flashes once every two seconds to indicate that the *THM Sentry is On*.
- **Alarm:** The LED flashes twice every two seconds to indicate an alarm.

The alarm can be triggered on either:

- A temperature outside of the set limits
- A relative humidity level outside of the set limit
- A totalizer value over the set limit.

Note: A motion alarm can be set for a specific number of events. In this case the alarm is triggered when the specified number of events has been detected. This is useful to know if the unit has been moved or touched. In this case the threshold is typically set to a small number of events. A motion

alarm can also be set for a specified number of hours. This is useful to know that the monitored equipment has run for the specified amount of time. For instance this can be used to perform preventive maintenance. In this case the threshold is typically set to a large number of hours of operation.

Once the condition for an alarm is encountered the alarm stays on until the condition subsides and the alarm is cleared.

The alarm is triggered by the value of the *ongoing* statistics, not the value of the *recorded* statistics. Therefore the alarm function is not influenced by the recording function.

There are two ways to clear an alarm:

- Press the button on the unit if the button is set to the *Clear* mode or the On/Off mode. Note that when the button is set for On/Off function, pressing the button will also power-on/power-off and start/stop a recording.
- Press the *Clear* button in the front-panel of the *THM_Sentry _Manager* application.

Either action clears the *ongoing* statistics and the corresponding alarm.

An alarm cannot be cleared if the condition that set the alarm is still present. For instance if the alarm is set for when the temperature is over 60 $^{\circ}C$, and the present temperature is 65 $^{\circ}C$, clearing the alarm will have no effect because a new alarm will be triggered again as soon as the present one is cleared.

To disable a specific alarm, simply set the corresponding threshold to a very large value. For instance setting the high temperature threshold to 500 $^{\circ}C$ will effectively disable the high temperature alarm.

To disable all alarms clear the *Alarm* check box in the *THM_Sentry_Manager* application.

7.7 Button Functions

The multi-function button can be set to trigger the following actions:

- **Clear an alarm:** Pressing the button clears the *ongoing* statistics and any corresponding alarm.
- **On-Off:** Pressing the button toggles the power on and off. In addition the unit starts recording a new log every time it is switched on and stops recording the current log every time it is switched off. This provides an easy way to start and stop recording without connecting to the *THM_Sentry_Manager* application. In this case the recording parameters (recorded data, log interval …etc.) are those that were last set using the application.

The button function can be selected with the *THM_Sentry _Manager* application.

7.8 Battery Life

The battery life depends on the model of *THM Sentry* and also on the use of the LED. Disabling the LED for either On/Off state or alarm state reduces the power consumption and correspondingly increases battery life.

When the *THM Sentry* is Off its only function is to keep track of the time. In this state the battery can last for more than 5 Years.

8 THM_Sentry _Manager Application

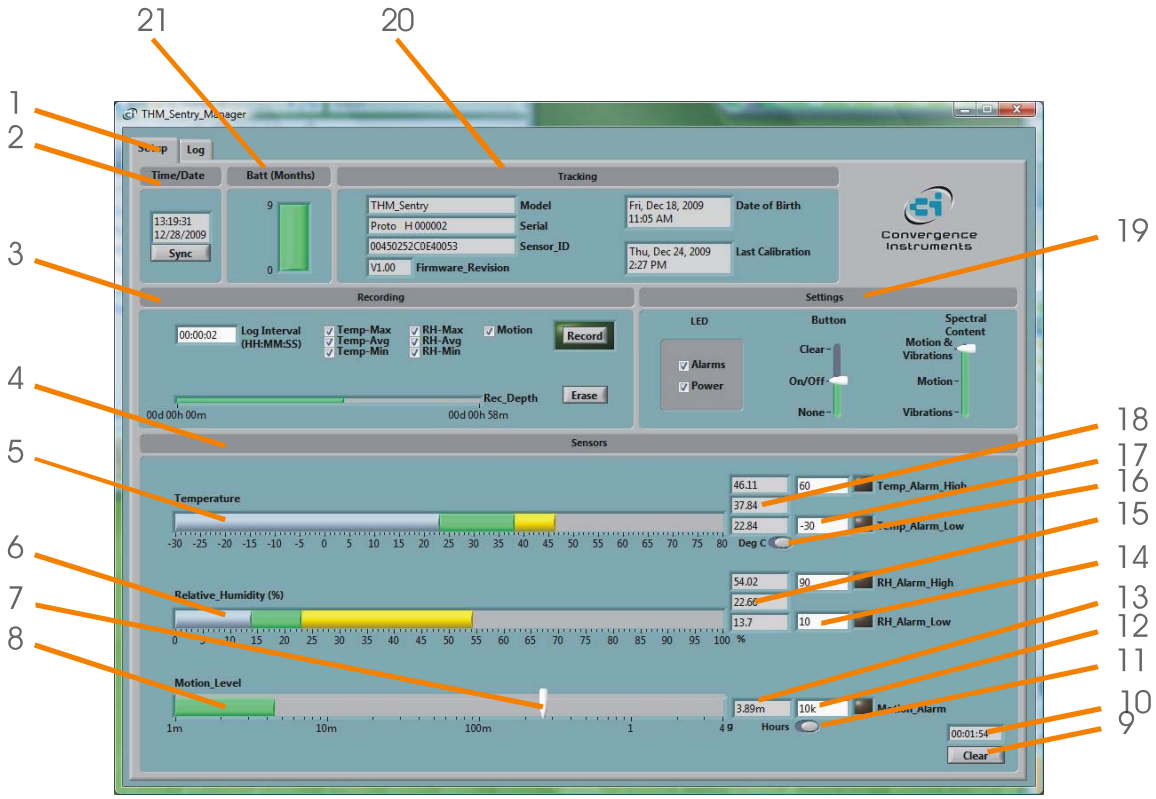


Figure 3: THM_Sentry _Manager *Setup* tab

Note: If a particular sensor is not present in the THM Sentry model connected to the application the corresponding controls and indicators are grayed-out.

1. Tab Selector
2. Date/Time Field
3. Recording Setup Field
4. Sensors Display and Ongoing Statistics Field
5. Real-Time Temperature Display (Min, Current, Max)
6. Real-Time Humidity Display (Min, Current, Max)
7. Motion Threshold
8. Real-Time Motion Level
9. Ongoing Statistics Clear Button
10. Ongoing Statistics Time (time since last clear)
11. Motion Totalizer Scale: Events or Hours
12. Motion Alarm Threshold. The threshold is set in the same scale as the toltalizer (Nb of events or hours)
13. Motion Totalizer Indicator
14. Humidity High and Low Alarm Thresholds
15. Humidity Min, Max and Current Digital Displays
16. Temperature Scale ($^{\circ}C$ or $^{\circ}F$)
17. Temperature High and Low Alarm Thresholds
18. Temperature Min, Max and Current Digital Displays
19. LED, Button and Motion Type Settings
20. Instrument Tracking Information (Serial number, Date of Birth…etc.)

21. Battery Level and Remaining Capacity (The bar graduation in months is dependant on the mode of operation (LED function, alarm present…etc.)

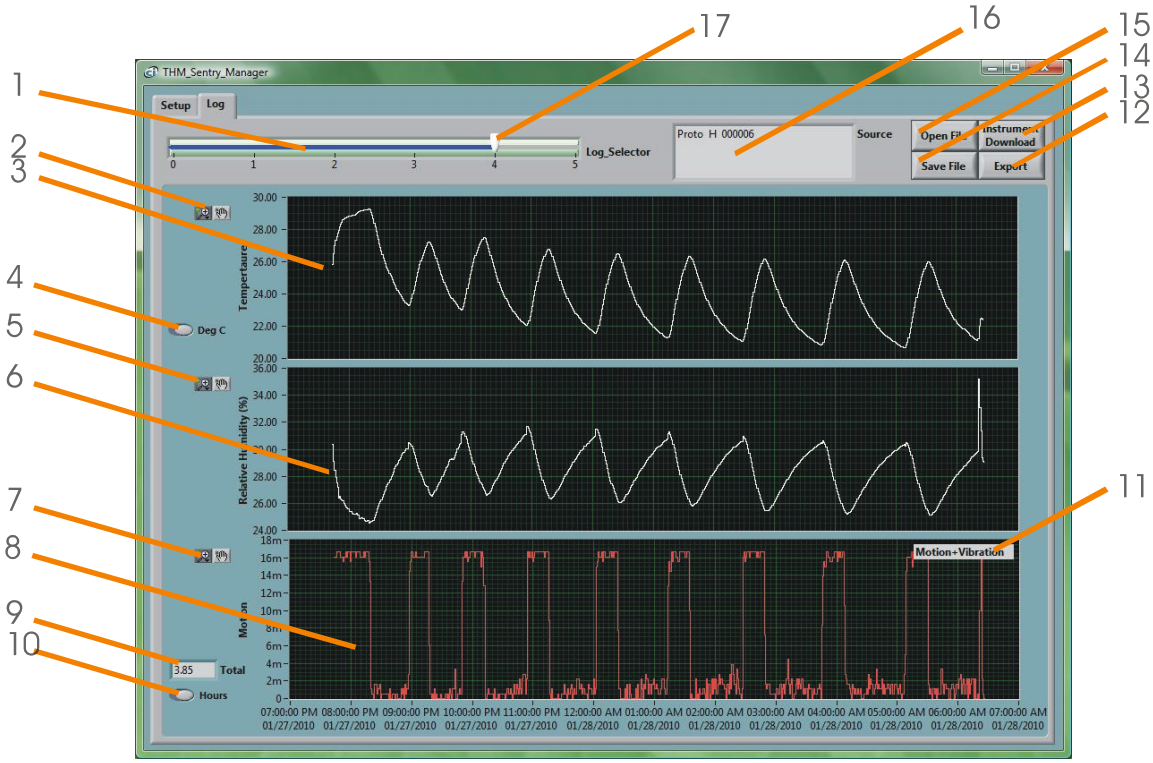


Figure 4: THM_Sentry _Manager *Log* tab

1. Log Contents Bar
2. Temperature Graph Pan and Zoom Buttons
3. Temperature Graph
4. Temperature Scale ($^{\circ}C$ or $^{\circ}F$)
5. Humidity Graph Pan and Zoom Buttons
6. Humidity Graph
7. Motion Graph Pan and Zoom Buttons
8. Motion Graph
9. MotionTotalizer
10. Motion Scale (Events or Hours)
11. Motion Type for the Log Displayed (Motion-Only, Vibration-Only or Motion&Vibration)
12. Export Button
13. Instrument Download Button
14. File Save Button
15. File Open Button
16. Data Source
17. Log Selector

8.1 Starting the Application

The application can be run with or without a *THM_Sentry* connected. When a *THM_Sentry* is not connected the application can only be used to display and analyze a previously saved log file. All the controls and indicators related to the instrument are grayed out.

To use the application to control a *THM_Sentry* do the following:

1. Connect the *MLI* cable into an available USB connector on the PC
2. Connect the other end of the *MLI* cable into the side of the *THM Sentry.* The *MLI* socket is polarized, if it does not insert easily, turn the connector over.
3. Go into *Start\All Programs\THM_Sentry*, and run *THM_Sentry_Manager.exe*.
4. The front-panel described in figure 3 appears, and the application tries to connect to the unit. If it fails to find the unit it indicates *No Device Found*. If this is the case see the *Troubleshooting* section. Otherwise the application immediately starts communicating with the *THM Sentry*.

8.2 Main Functions

The application has two main tabs:

- **The *Setup* Tab:** Is used to setup the instrument and read current levels and ongoing statistics (see figure 3).
- **The *Log* Tab:** Is used to read, display and export the data from the *THM Sentry's* recording memory (see figure 4).

8.3 Setup Tab

The setup tab is seen in figure 3. The setup tab is divided into six fields.

8.3.1 Time and Date Field

This field displays the internal time of the unit. If the unit time is not properly adjusted, press *Synchronize*. This synchronizes precisely the unit time to the PC time.

Note: Time synchronization is not allowed while the unit is recording. Attempting to synchronize the time while a recording is in progress will trigger an error message to that effect.

8.3.2 Battery Condition Field

This field indicates the remaining battery capacity, as well as the total battery life (at the upper scale marker). The total battery life changes with specific instrument model, as well as the LED display settings. Changing the LED functions is reflected in the battery scale to the left of the indicator.

8.3.3 Tracking Field

The tracking field provides instrument information, such as instrument model, serial number and firmware revision.

8.3.4 Recording Setup Field

Check boxes allow the user to select which measurements to record.

The *Recording Depth* bar provides two indications:

- The percentage of memory already used.
- The total memory capacity, in Days-Hours-Minutes. The total memory capacity is calculated as a function of the number of selected measurements and the log interval. It changes to reflect the maximum recording duration as log interval or selected measurements are changed.

The *Log Interval* can be adjusted in Hours-Minutes-Seconds.

Note: Recording settings cannot be modified while a recording is in progress. Attempting to change the settings while a recording is in progress will trigger an error message to that effect.

To start a recording from the application press the *Record* button in the *Recording Setup* field. To stop a recording press the *Record* button again. A log is defined as a stretch of recording between the moment the recording is started and the moment it is stopped. Each time a recording is started a new log is created and stored in memory after the previous one. New logs can be created as long as there is enough recording memory available.

To erase the contents of all the recording memory and make room for new logs press the *Erase* button.

Note: Pressing the physical button on the THM Sentry unit instead of the Record button on the Setup tab of the application will also start and stop the recording if the button is configured to do so. However this will also switch the unit On and Off. Switching the instrument Off while connected to the application is allowed. However the instrument will no longer take measurements. Everything will appear to be frozen until the unit is switched On again.

8.3.5 Ongoing Measurements and Statistics Field

This field provides information about the current temperature, humidity and motion levels and statistics.

8.3.5.1 Temperature

The temperature bar shows the min, max and current temperature. To the right of the bar the digital displays show the same information.

The Scale button selects the $^{\circ}C$ or $^{\circ}F$ scale. Temperatures and alarms are displayed and set in the chosen scale. The scale can be changed at any time.

To the right of the digital displays are the high and low alarm thresholds. Alarm thresholds can be changed at any time. Alarm threshold values are set in the same scale that is used to display temperatures.

An alarm is triggered when the max value is higher than the high threshold, or when the min value is lower than the low threshold. Alarms stay active until the *Clear* button is pressed, which also clears the max and min values.

To the right of each alarm threshold is a red indicator. The indicator lights up when the corresponding alarm is in effect.

8.3.5.2 Relative Humidity

The humidity bar shows the min, max and current humidity levels in %. To the right of the bar the digital displays show the same information.

To the right of the digital displays are the high and low alarm thresholds. Alarm thresholds can be changed at any time.

An alarm is triggered when the max value is higher than the high threshold, or when the min value is lower than the low threshold. Alarms stay active until the *Clear* button is pressed, which clears the max and min values.

To the right of each alarm threshold is a red indicator. The indicator lights up when the corresponding alarm is in effect.

8.3.5.3 Motion

The motion bar shows the current acceleration measured by the accelerometer in g. A new measurement is taken for 50 ms every 2s. The level indicated when the instrument is at rest is the noise level of the accelerometer.

The white index on the bar sets the motion sensitivity threshold. Whenever the acceleration level is measured over the sensitivity threshold a motion event is added to the totalizer. To properly detect motion events, the motion threshold should be set to a value high enough so that the accelerometer noise level will not randomly go over the threshold.

The totalizer to the right of the acceleration level bar shows the total number of events that occurred since the *Clear* button was last pressed. The totalizer scale button sets the display in number of events or in number of hours. The number of hours is calculated as the sum of all the 2s intervals where motion was detected. The scale can be changed at any time.

To the right of the totalizer is an alarm threshold. A motion alarm is triggered whenever the value in the totalizer is greater than the alarm threshold. The motion alarm threshold is displayed and set in the chosen scale (Events or hours).

To the right of each alarm threshold is a red indicator. The indicator lights up when the corresponding alarm is in effect.

8.3.6 Settings Field

8.3.6.1 Button Function

The Button function selector defines the function of the button:

- **Clear:** Pressing the button clears the ongoing statistics and the alarms if alarms are in effect.
- **On-Off:** Pressing the button toggles recording and power On and Off. When the unit is switched-on a new recording is started. When the unit is switched-off the current recording is stopped. The recording uses the current settings.
- **None:** The button has no effect. Use this setting to avoid improper user intervention during measurements or recording.

Note: Pressing the physical button on the THM Sentry unit while the application is running is allowed. However if the instrument is switched-off it will no longer take measurements. Everything will appear to be frozen until the unit is switched on again.

8.4 Log Tab

The log tab is seen in figure 4. It is used to retrieve the recorded information from the *THM Sentry* or from a saved file, and to display and export the recorded logs.

1. **Log Number Indicator:** The scale indicates the number of logs in memory. This scale is updated whenever data is downloaded from the instrument or from a file.
2. **Temperature Pan and Zoom Buttons:** The magnifier glass has several modes for zooming in X and Y, or to go back to the full size view (auto-scale). The hand is used for panning in X and Y.
3. **Temperature Graph:** Displays temperature min, max and/or average as a function of time. If a particular measurement was not recorded the corresponding curve is absent from the graph.
4. **Temperature Scale Button:** Sets the scale to either $^{\circ}C$ or $^{\circ}F$.
5. **Humidity Pan and Zoom Buttons:** The magnifier glass has several modes for zooming in X and Y, or to go back to the full size view (auto-scale). The hand is used for panning in X and Y.
6. **Humidity Graph:** Displays humidity min, max and/or average as a function of time. If a particular measurement was not recorded the corresponding curve is absent from the graph.
7. **Motion Pan and Zoom Buttons:** The magnifier glass has several modes for zooming in X and Y, or to go back to the full size view (auto-scale). The hand is used for panning in X and Y.
8. **Motion Graph:** Displays motion in number of events or hours in motion.

9. **Motion Totalizer:** Displays the total number of motion events or the total number of hours in motion. The total indicated corresponds to the displayed window. Zooming on a particular time frame excludes the data outside of the zoom window. When displaying motion time the format is Hours:Minutes:Seconds.
10. **Motion Scale Button:** Selects motion display in number of events or number of hours in motion.
11. **Motion type indicator:** Indicates what the motion type setting was for the log currently displayed.
12. **Export Button:** Press the button to export the record presently displayed to an Excel Tab-delimited file.
13. **Instrument Download Button:** Press the button to download all the logs from the instrument to the screen for visualization and/or exporting.
14. **File Save Button:** Press the button to save all the data downloaded from the instrument to a file for later recall and analysis. A browser window appears to select the file name and location.
15. **File Open Button:** Press the button to recall data previously saved in a log file.
16. **Data Source Indicator:** Indicates the source of the data being displayed. This is either the serial number of the instrument from which the data was downloaded, or the name of the file from which the data was read.
17. **Log Selector:** Selects a particular log in memory for display. The first recorded log has index 0, the last log has index N-1. When the recording memory is initially read the index is set to the newest (last) log in memory.

Tip: Writing a new value directly to either the first or last marker of the X or Y scale rescales the graph so that this value is at the edge. This is a good way to set the scales precisely.

9 Maintenance

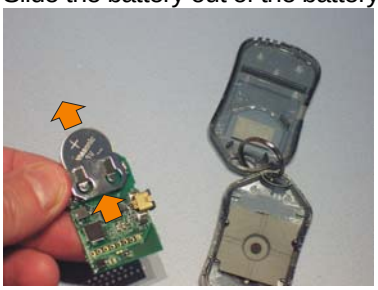
9.1 Battery Change

To change the battery, follow the procedure below:

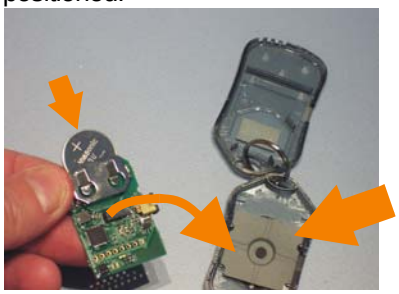
1. Slide a flat screwdriver in the crack on the side of the unit.
2. Gently twist the screwdriver to unsnap the unit open. Be careful not to damage the casing. If necessary repeat the operation at several locations around the casing.

3. Take the printed-circuit board out of the casing.

4. Slide the battery out of the battery holder.



5. Slide a new battery in, making sure you observe the proper polarity. The positive contact of the battery (outer casing of the battery) should face up where the + of the battery holder is printed.
6. Make sure the LED starts blinking.
7. Reposition the printed-circuit board within the two half shells. Make sure the button is correctly positioned.



8. Snap the two half shells back together.

9.1.1 Reset Procedure

With the battery out of the battery holder, insert a small coin inside the battery compartment so that it touches the metal on both sides of the compartment. Be gentle to avoid damaging the surface of the printed circuit. Be certain that the coin touches both sides of the compartment; otherwise the reset will not be effective.

9.1.2 Battery Type

A BR2032 or CR2032 lithium battery should be used to power the device at all times. The BR2032 has a wider temperature range (-30 $^{\circ}C$ to +80 $^{\circ}C$), but a slightly lower capacity. The CR2032 has a temperature range of -20 $^{\circ}C$ to +70 $^{\circ}C$).

9.2 Cleaning

Only use a damp sponge or soft cloth. Do not use any liquids that might enter through the measurement openings.

Be careful not to obstruct the measurement openings or the inside of the *MLI* connector.

If the inside of the connector needs cleaning, use compressed air to dislodge any debris.

Do not use solvents. Chemical vapors can offset the humidity sensor.

9.3 Software and Firmware Upgrades

Software upgrades are found on our web site: www.convergenceinstruments.com.

After upgrading the *THM_Sentry _Manager* application, if a firmware upgrade is required it will be applied automatically when the application is started.

10 Troubleshooting

10.1 Cable Driver Installation

If the *THM_Sentry _Manager* application is unable to communicate with the *THM Sentry* it may be because the *MLI* cable driver failed to install properly. To check the cable driver installation follow the procedure below:

1. Disconnect the *MLI* cable from the PC.
2. Open the *Device Manager* on the PC. This is usually found in *Control Panel – System and Maintenance*.
3. Open the *Ports (COM and LPT)* item on the right.
4. Connect the *MLI* cable (Make sure you are using the *MLI* cable for the *THM Sentry* and not a standard USB cable).
5. Observe that the *Device Manager* window refreshes.
6. Under *Ports (COM and LPT)* verify that an item named *USB Serial Port (COMx)* has been created.
7. If not, disconnect the *THM Sentry* USB cable. Then reinstall the software.

10.2 Connection Problems

Failure to communicate with the PC can also be caused by poor *MLI* cable contacts. Make sure the *MLI* connector is fully inserted into the socket of the *THM Sentry.* Inspect the inside of the plug at the end of the cable, as well as the *MLI* socket on the unit. If dirt or debris is lodged in the plug or socket, use a can of compressed air to expel it.

10.3 Battery Problems

If the *THM Sentry* fails to communicate and to switch on or off, make sure the battery is fresh and is properly inserted in its holder.

10.4 Button Response

If the *THM Sentry* fails to respond to button presses, make sure the *Button Function* is properly set. A setting of *Clear* or *None* will not show any visible change when the button is pressed.

11 Specifications

Dimensions	5.7 cm x 3.5 cm x 1.1 cm (2.25 in x 1.35 in x 0.43 in)
Weight	15 g (0.5 oz)
Measurements	• MaxTemperature • Avg Temperature • Min Temperature • Max Relative Humidity (*THM12N* Model only) • Avg Relative Humidity (*THM12N* Model only) • Min Relative Humidity (*THM12N* Model only)

Alarms	• Motion (Number of events or hours of operation) • MaxTemperature • Min Temperature • Max Relative Humidity (*THM12N* Model only) • Min Relative Humidity (*THM12N* Model only) • Motion (Number of events or hours of operation)
Battery life	• 12 months to 19 months (*TM12* model, depending on mode of operation) • 9 months to 13 months (*THM12N* model, depending on mode of operation)
Battery type	• BR2032 lithium battery for full temperature range • CR2032 lithium battery for reduced temperature range
Temperature range (operating and storage)	• --30 $°C$ to 80 $°C$ (-22 $°F$ to 176 $°F$) if BR2032 battery • -20 $°C$ to 70 $°C$ (-4 $°F$ to 158 $°F$) if CR2032 battery
Temperature resolution	• 0.06 $°C$ /0.12 $°F$ (TM12) • 0.01 $°C$ /0.018 $°F$ (THM12N)
Temperature precision (typical) **(see curves below)**	• 0.5 $°C$ /0.9 $°F$ (TM12) • 0.3 $°C$ /0.54 $°F$ (THM12N)
Temperature time constant	• < 15 min still air • < 6 min circulating air
Relative humidity normal range (operating and storage)	• 0 to 80% *Note: Operating range is further restricted to values with dew point between -40 $°C$ and 80 $°C$.*
Relative humidity extended range	• 0 to 99% (non-condensing) *Note: Between 80% and 100% the sensor may read a reversible offset with slow kinetics (<3% after 200 hours at 90% RH)*
Relative humidity resolution	• 0.04%
Relative humidity precision (typical) **(see curves below)**	• 2%
Relative humidity hysteresis (typical)	• 1%
Relative humidity time constant	• < 15 min still air • < 6 min circulating air
Motion detector number of axes	• 3 axes (omni-directional)
Motion type detected	• Motion only (low frequencies) • Vibrations only (high frequencies) • Motion + Vibration
Motion noise level	• Better than 10 mg (100 10^{-3} m/s^2)

Motion threshold range	• Adjustable 0 to 3.5g
Measurement interval	• 2s
Recording interval	• Adjustable 2s to 12H, with 2s resolution
Recording memory type	• Non-Volatile
Recording/erasure cycles	• More than 10 000
Recording memory Depth	• 12 000 individual measurement points

11.1 Maximum Tolerance

11.1.1 Temperature

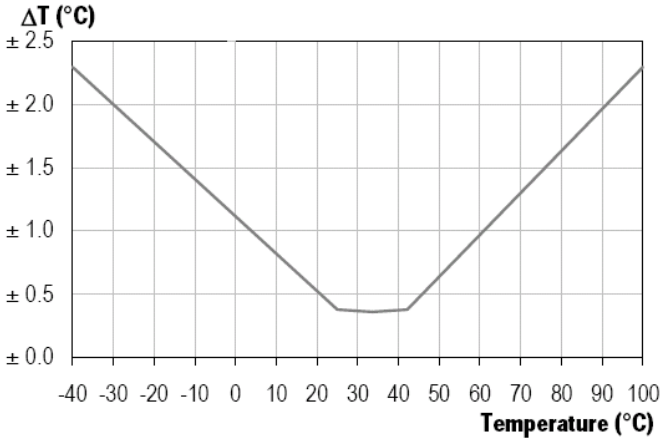


Figure 5: Maximum Temperature Tolerance

11.1.2 Relative Humidity

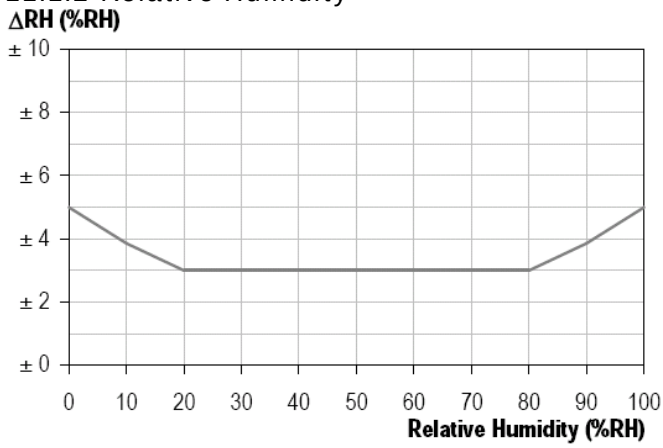


Figure 6: Maximum Humidity Tolerance at 25 $^{\circ}C$